Remarks/Arguments

Reconsideration and allowance are respectfully requested in light of the following remarks. Claims 1, 3, 5-8 and 20-29 and 32-35 remain pending. New claims 36-40 have been added. Claims 2, 4, 13-19 and 30-31 were previously cancelled and claims 9-12 have been canceled in this amendment. Claims 1, 3, 5-12 and 20-26 have been withdrawn from consideration. Claim 27 has been amended in this Amendment.

Withdrawn claims 20-26 are appropriate for rejoinder on the allowance of the elected claims (see MPEP §§821.04(a) and (b)).

Claims 27-29 and 32-40 are directed to an aqueous binder composition for making glass fiber products. Claim 27 is independent and the remaining claims are dependent. Claim 27 has been amended to introduce the recitation that the unsaturated carboxylic acid monomer and the unsaturated hydroxyl monomer comprise a major portion by weight of the claimed water soluble adduct. New claim 36 specifies that the unsaturated carboxylic acid monomer and the unsaturated hydroxyl monomer comprise at least 55.5 percent by weight of the claimed water soluble adduct. New claims 37-40 depend from claim 36 and recite a specific unsaturated carboxylic acid monomer, a specific unsaturated hydroxyl monomer and the presence of an ionic monomer and specifically sodium para-styrene sulfonic acid, respectively. Support for the amendment to claim 27 and for new claims 36-40 is in Examples 1, 1A, 1B, 2, 6, 6A, 8, 8A, 10 and 12 (as shown below in tabular form).

In the prior response, claim 27 had been amended to require that the claimed "water soluble adduct" be produced by a solution polymerization that is accomplished in an aqueous environment, *i.e.,* "an aqueous free radical solution polymerization." No new matter has been introduced by any of the amendments.

Claims 27-29 and 32-35 stand rejected under 35 U.S.C. 103(a), as being unpatentable over Pourahmady et al (U.S. 5,498,658) – the Pourahmady '658 patent. This rejection is respectfully traversed.

In framing this rejection, the Office Action has overlooked fundamental differences between the subject matter described by the cited Pourahmady '658 patent and the subject matter defined by the pending claims. In particular, the Pourahmady '658 patent is directed to a polymer that (1) is prepared from only a minor portion (by weight) of an unsaturated carboxylic

acid and an unsaturated hydroxyl monomer,[1] (2) requires that (meth)acrylonitrile be included in the polymerization mixture and (3) constitute a formaldehyde-free **latex**, *i.e.,* the polymer of the Pourahmady '658 patent is an emulsion or a suspension of water-insoluble polymer particles and thus the polymer is **NOT** water soluble.

In contradistinction, the pending claims require that the polymer be a "water soluble adduct" and that the major portion by weight of the claimed water soluble adduct recitation comprise the mixture of the unsaturated carboxylic acid monomer and the unsaturated hydroxyl monomer (claim 27) (New claim 36 in particular specifies that the unsaturated carboxylic acid monomer and the unsaturated hydroxyl monomer comprise at least 55.5 percent by weight of the claimed water soluble adduct).

The Pourahmady '658 patent does not make this combination of requirements, along with other elements in claim 27, *prima facie* obvious. Pointedly, as described in the Pourahmady '658 patent examples, the latex of the Pourahmady '658 patent is prepared by an **emulsion polymerization[2];** while in accordance with the pending claims, the claimed water soluble adduct is prepared by "an aqueous free radical solution polymerization." This fundamental difference in the nature of these two materials results from the differences in the monomers and their relative proportions in making the respective polymers, a difference in relative proportion that is now recited in the pending claims.

Further, the Pourahmady '658 patent requires the use of (meth)acrylonitrile as an essential component (subpart (c) of the monomer components – in an amount of 1-60 phr), does not require that the functional monomer bear a hydroxyl group (a hydroxyl is only one of several optional nucleophilic groups Y for the functional monomer, see lines 2-4 of col. 3) and permits up to 80 phr of what are hydrophobic monomers (subparts (d) and (e)).

In contrast, the present invention requires monomers bearing both carboxyl and hydroxyl groups in a particular mol ratio and in a major amount to yield a "water soluble adduct." As discussed in paragraphs **[48]** and **[49],** hydrophobic monomers generally should constitute at

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[1] Actually the '658 patent does not use only an unsaturated hydroxyl monomer, but also contemplates other functional monomers.

[2] The brief reference to solution polymerization "utilizing polar and non-polar solvents" (col 3, lines 52-56) in the Pourahmady '658 patent does not constitute a clear and direct teaching to make water-soluble polymers, particular in view of the pervasive references to latex and emulsion polymerization.

most about 20% by weight, or up to 40% by weight when using charged monomers, but nowhere near the up to 80% contemplated by the Pourahmady '658 patent.

These monomer distinctions are particularly evident in a comparison of the specific examples. In the Pourahmady '658 patent examples (summarized in Table IV and V of the Pourahmady '658 patent – and presented in tabular form below for the Examiner's convenience), both the functional monomer and the dicarboxylic acid component generally each constituted less than about 10% of the monomer mixture, with the acrylonitrile and hydrophobic monomer generally, jointly comprising about 80% and higher. The highest content of a hydroxyl monomer was only 8% (Example 2).[3] Pointedly, the combination of the carboxyl monomer and the functional monomer in every example was never more that 22.5 percent by weight of the Pourahmady polymer (see the Table below). As shown in the last column of the following Table, in every example of the Pourahmady patent the sum of the carboxyl monomer and the hydroxyl monomer (or in Pourahmady's case the functional monomer) constituted a very minor portion of the polymer's monomer content.

	Mononers Present in Polymer of '658 Patent				
Example	-COOH Monomer	-OH (or Functional) Monomer	Other Monomers	Total Mononers	Percentage of –COOH and –OH (or Functional) Monomers
1	13.0	9.5	77.5	100	23
2	8.5	8	83.5	100	16.5
3	6.5	6	87.5	100	12.5
4	6.5	6	87.5	100	12.5
11	9.5	13	77.5	100	22.5
12	9.5	13	77.5	100	22.5
13	4.5	6	89.5	100	10.5
14	6.6	4	89.5	100	10.5
15	6.5	6	87.5	100	12.5
16	8.5	10	81.5	100	18.5
17	8.5	10	81.5	100	18.5
21	6	5	89	100	11
22	6	5	89	100	11
25	6.5	5	88.5	100	11.5
26	5	5	90	100	10
28	6.5	13	80.5	100	19.5
29	5.5	5	89.5	100	10.5

[3] Example 22 in Table IV appears to have "50 HEA." However, as is clear from the distribution of the remaining monomers and Example No. 22 in Table V, this was actually supposed to be 5.0 HEA.

In contrast, in the illustrative Examples of the present invention, as summarized in the Table below, where the approximate amounts of the various monomers are detailed, the sum of the carboxyl and hydroxyl monomers was always in excess of 50 %, and typically in excess of 66 %. The differences between the Pourahmady '658 patent and the claimed invention are striking.

Monomers Present in Polymer of Invention

Example	-COOH Monomer	-OH Monomer	Other Monomers	Total Monomers	Percentage of –COOH and –OH Monomers
1, 1A, 1B	270	313	0	583	100
2	58.3	92.8	0	151.1	100
6	60	58.3	20	138.3	85.5
6A	60	42.4	30.6	133	77.0
8	282	375	332	989	66.4
8A	282	375	282	939	70.0
10	95.17	20	92.4	207.6	55.5
12	70.4	56.58	62.87	189.8	66.9

The recent Office Action, citing Col. 3, lines 52-55 of the Pourahmady patent, argues that the prior art teaches conventional polymerization methods including solution polymerization. At this location in the Pourahmady patent the following is recited:

> The interpolymers of the present invention can be made by emulsion, dispersion, or suspension polymerization or by solution polymerization utilizing polar and/or non-polar solvents. The preferred method is an emulsion polymerization method to give an interpolymer latex. This process is generally conducted in the presence of water, an emulsifier, and an initiator, as well as other such polymerization aids. The process typically produces a latex containing more than 20% by weight solids, preferably more than 30% by weight solids, which is usable per se as a binder without having to be combined with other latex polymers. The precise amount of solids will depend upon the monomers chosen as well as the polymerization steps and other ingredients.

While there is a passing remark that solution polymerization might be used, there is no teaching showing how it can be used and there is no exemplification demonstrating that it even

could be used. No where else in the Pourahmady patent is there another reference to "solution polymerization." In this case where the cited reference so overwhelmingly favors the use of emulsion polymerization and the formation of a latex polymer and does not provide one single reference that a water soluble polymer can even be prepared, this passing reference to "solution polymerization," does not provide support for the obviousness rejection. A skilled worker given the teachings of the Pourahmady patent simply would not have found it obvious to make a water soluble binder in accordance with the limitations of the pending claims. The non-obvious nature of new claims 36-40 is particularly striking. The Pourahmady patent does not illustrate the specific combination of monomers required by these claims in the recited proportions.

Claims 27-29 and 32-35 also stand rejected as being unpatentable within the meaning of 35 U.S.C. 103(a) over Reck et al., U.S. Patent 6,114,464 (Renk '464). This rejection also is respectfully traversed.

Renk '464 describes a thermally curable mixture of hydroxyalkylated polyamines and polycarboxylic acids useful as binders for shaped articles, such as chipboard. Renk's binder composition requires two distinct components **(1)** a water-soluble, linear or branched aliphatic compound containing at least two functional amino groups and having at least one hydroxyalkyl moiety (*i.e.,* a complex alkanolamine) and **(2)** an addition polymer containing from 5 to 100% by weight of units derived from at least one ethylenically unsaturated mono- or dicarboxylic acid and obtainable by free-radical polymerization. The addition polymer, **component (2)** contains from 5 to 100% by weight, of units derived from at least one ethylenically unsaturated mono- or dicarboxylic acid. Other vinyl compounds that can be polymerized with the unsaturated mono- or dicarboxylic acid(s) are described in columns 15-16 of the Renk '464 patent.

As the Office Actions have noted some of the unsaturated monomers suggested by Renk for co-reaction with the at least one ethylenically unsaturated mono- or dicarboxylic acid in preparing **component (2)** are compounds having a hydroxyl moiety, such as hydroxyethyl (meth)acrylate. Renk, however, does not specifically describe using such monomers to make **component (2)** and does not indicate at what level such compounds should be used. In those examples where a non-carboxylic acid monomer was used, Examples D, F and G, the Renk '464 patent used methyl methacrylate, ethyl acrylate and styrene as the non-carboxylic acid monomers. These are no mention of hydroxyl monomers in the Examples.

Indeed, we submit that based on the entirety of Renk's teachings a skilled worker would not have found it obvious to use such monomers in the amount required by the pending claims for preparing the "water soluble adduct resulting from free radical solution polymerization of an unsaturated carboxylic acid monomer having a molecular weight of less than 750 and an unsaturated hydroxyl monomer having a molecular weight of less than 750."

As presently defined, the pending claims require that the polymer be primarily made (*i.e.,* the major portion by weight be) of the unsaturated carboxylic acid monomer and the unsaturated hydroxyl monomer and that a sufficient amount of the unsaturated hydroxyl monomer be supplied so that the COOH:OH ratio of the resulting adduct be in the range of 1.5:1 to 0.7:1. We submit that nothing in Renk would have led a skilled worker to this particular proportion of materials.

Indeed, we submit that when a skilled worker considers the actual examples presented by Renk for illustrating the invention and also considers other specific teachings in the application, the skilled worker would conclude that Renk '464 favors the use of **component (1)**, *i.e.,* the linear or branched aliphatic compound containing at least two functional amino groups (*i.e.,* the complex alkanolamine), generally as the sole source and clearly as the primary source of hydroxyl groups for reacting with the carboxylic acid addition polymer, **component (2)**.

Renk teaches (in the paragraph bridging columns 18 and 19) that the complex alkanolamine (**component (1)**) and the addition polymer (**component (2)**) are preferably used

> in such a relative ratio that the molar ratio of carboxyl groups of component (2) to hydroxyl groups of component (1) is within the range from 20:1 to 1:5, preferably within the range from 8:1 to 1:2, particular preferably within the range from 4:1 to 1:1.

Including a substantial amount of hydroxyl groups as part of the molecular make-up of **component (2)** would significantly alter the COOH to OH ratio in a way Renk does not consider or discuss. Indeed, it is apparent in the progression of Renk's preferred, to more preferred, to most preferred COOH:OH ratio ranges that Renk favors the presence of excess carboxyl (COOH) groups, a preference that would be upset by the presence of a significant fraction of hydroxyl (OH) groups as part of the addition polymer itself.

Thus, when one considers that all of the Examples in the Renk '464 patent appear to use solely unsaturated carboxyl monomers for making the addition polymer, **component (2)**, and that the use of an unsaturated hydroxyl monomer for making the addition polymer is not remotely mentioned in the examples, a skilled worker would not have found it obvious to produce a binder composition containing the a water soluble adduct required by the pending claims.

Applicants request reconsideration of the pending claims in view of the foregoing amendments and arguments.

Respectfully submitted,

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